Instructor:	Prof. Anthony Várilly-Alvarado	**Time:**	MWF 2:00-2:50PM
Office:	222 Herman Brown	**Classroom:**	Herzstein Hall 210
Email:	`varilly@rice.edu`	**Office Hours:**	W 5-6PM, F 3-4PM

Class Webpage: Look for `Math 354 001 Fa15` on Owlspace.

Teaching Assistants: TBA.

Prerequisites: A 200-level Math course is recommended. Some exposure to linear algebra at the level of Math 211 or 221/222 would be great, but is not strictly necessary. The only real prerequisite is the willingness to think hard about abstract mathematics, and to spend time grappling with ideas that will change your life. Talk to me if you are unsure whether you are ready to take this class.

Text: Sheldon Axler, *Linear Algebra Done Right* (Third edition). Undergraduate Texts in Mathematics, Springer, New York 2015. ISBN: 978-3-319-11079-0.

Homework: Due once a week, on **Friday, at 5pm** in my office. You are welcome to hand in the homework at the beginning of lecture on Friday.

The homework is not pledged and you can collaborate with other students in the class. In fact, you are very much encouraged to do so. However, you are not allowed to look up solutions in any written form; in particular, you are not allowed to look up solutions online. You should write up your solutions individually.

This is a very important component of the course. This class has a heavy workload, and you should expect to spend a lot of time doing homework. Math 354 is in many ways similar to a language course: you must get lots of hands-on practice to internalize the definitions.

Exams: There will be two in-class midterms, on **Friday, September 25th** and on **Friday, October 30th**. There will also be a written, 3-hour final exam.

> **Final exam:** The date for the final exam is not available at this time. It is the policy of the Mathematics Department that no final may be given early to accomodate student travel plans. If you make travel plans that later turn out to conflict with the scheduled exam, then it is your responsibility to either reschedule your travel plans or take a zero in the final.

If an exam conflicts with a holiday you observe, please let me know.

Grades: Homework will count for 30% of your final grade; your lowest homework score will be dropped. Each midterm will count for 17.5% of your grade (for a total of 35%) and the final exam will count for 35% of your grade.

Attendance: Attendance is not required. However, you are responsible for all the material and announcements covered in lecture. While Owlspace is a valuable resource, not all announcements will be posted there. Nevertheless, you are responsible for reading any emails I send to the class through Owlspace.

Expectations: In my experience as a student, most people do not follow all the details of a Math lecture in real time. During lecture, you should expect to witness the big picture of what's going on. You should pay attention to the lecturer's advice on what is important and what isn't. A lecturer spends a long time thinking about how to deliver a presentation of an immense amount of material; they do not expect you to follow every step, but they do expect you to go home and fill in the gaps in your understanding. Not attending lecture really hurts your chances at a deep understanding of the material.

Disability Support: Any student with a documented disability seeking academic adjustments or accommodations is requested to speak with me during the first two weeks of class. All such discussions will remain as confidential as possible. Students with disabilities will need to also contact Disability Support Services in the Allen Center.

Topics to be covered

I plan to cover most of Axler's book, supplemented by some applications to show you the power of linear algebra within science, e.g., by providing precise language to explain Heisenberg's uncertainty principle, and in real life, e.g., by looking at Google's PageRank algorithm, which sorts out webpages according to their relative importance. This will require us to cover Chapter 4 of the book quickly, and to most likely omit Chapter 9.

1. **Vector Spaces and linear maps:** Definitions and basic properties.; linear independence, span, bases, dimension. Rank-nullity theorem. Time permitting: quotient spaces and duality.

2. **Subspaces and eigenvalues:** Invariant subspaces and existence of eigenvalues.

3. **Inner product spaces:** Orthonormal bases and the Gram-Schmidt algorithm.

4. **The Spectral Theorem:** Orthonormal bases of eigenvectors. Time permitting: Polar and Singular Value Decomposition.

5. **Minimal + characteristic polynomials:** Generalized eigenvectors; Jordan canonical form.

6. **Trace and Determinant:** Basics and properties. Time permitting: Strassen's algorithm.

7. **Applications:** Included throughout the above topics: Google PageRank and the Heisenberg Uncertainty Principle (including the basics of axiomatic quantum mechanics).